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AUTHOR Geiger, William L.
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ABSTRACT

Compared were the perceptual and gross motor abilities of 30 mentally retarded and 25 nonretarded 10- to 12-year-old children. Performance data on such motor tasks as the agility run, 20-yard dash, obstacle course, and target hop were recorded, with separate data for the retarded Ss on the basis of etiological classification (Down's Syndrome, cultural-familial, and other). Among findings were significant differences between the performances of nonretarded and retarded groups and among the etiologically classified groups. (CL)

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THE PERCEPTUAL- AND GROSS-MOTOR ABILITY OF MENTALLY RETARDED CHILDREN

by

William L. Geiger

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An Abstract of

THE PERCEPTUAL- AND GROSS-MOTOR ABILITY OF MENTALLY RETARDED CHILDREN

William L. Geiger

The purpose of this study was to compare the performances of mentally retarded and non-mentally retarded children on specific motor tasks to evaluate the retarded child's perceptual-motor ability and its relationship to his gross-motor performance. A further purpose of this investigation was to examine the variance in motor ability reported among mentally retarded children etiologically classified as Down's Syndrome, cultural-familial, and other (organic/physiological).

The subjects for this study consisted of 30 children involved in the Mt. Pleasant, Michigan Public School System who were 10, 11, or 12 years of age and diagnosed as mentally retarded. They were also classified into three groups on the basis of etiology. These groups were: Down's Syndrome, cultural-familial, and other (organic and/or physiological). The non-retarded children were randomly selected from the elementary school population of Mt. Pleasant, Michigan and consisted of 25 children who were 10, 11, or 12 years of age.

The tasks used in this study consisted of perceptual- and gross-motor activities that included reaction time, movement time, agility run, 20 yard dash, obstacle course, and target hop.

The analysis of data indicated significant correlations between intelligence, age, reaction time, movement time, 20 yard dash, agility run, obstacle run, target hop, and motor ability of the retarded children. Significant correlations were obtained between the non-retarded subjects' intelligence, age, reaction time, movement time, 20 yard dash, agility run, obstacle run, target hop, and motor ability. Variables indicative of perceptual-motor ability, RT and MT, were found to correlate significantly with the motor ability scores of the non-retarded group but this interrelationship did not occur significantly in the retarded group.

There was a significant difference between the performances of the non-retarded and the retarded groups with regard to motor ability. A significant difference in motor ability among the etiologically classified groups of retarded children was obtained. A ranking from best to poorest mean motor ability score was as follows: non-retarded, cultural-familial, Down's Syndrome, and other (organic/physiological).

Within the framework of this study the following conclusions appeared warranted: There was a considerable amount of variability among the retarded subjects indicative that retarded children are not homogeneous with regard to motor ability characteristics but demonstrate very diverse behavior from one person to another. Secondly, a pattern of motor ability was not characteristic of a specific etiologically classified group of retarded children, thereby reinforcing the importance of providing movement experiences for retarded children on the basis of individual rather than group ability. Finally, there was a significant relationship between intelligence and the motor ability performance of mentally retarded children; however, for the non-retarded children no relationship was obtained.

CHAPTER I

INTRODUCTION

One of the basic components necessary to attain a satisfying and enjoyable life is freedom and ease of movement. Man is created to move. Biologically, some degree of movement is necessary to maintain life. The individual who can move freely can express himself through movement as a free individual. Many of man's basic patterns of life, comprehensions, and reactions to his environment depend upon efficiency of movement.

Absence of physical ability attributes (i.e., coordination, strength, fitness, fundamental movement skills) limits one's exploration and mastery of his environment and, therefore, deprives an individual of the many significant stimuli available to the active person. The freedom of movement provided by the possession of an adequate performance level fosters a feeling of confidence, achievement, and success which every individual needs. However, the retarded do not have this freedom as they apparently lack a sufficient level of motor ability. Motor ability refers to the quality of performance a person exhibits on various large muscle tasks such as running, jumping, balancing, and throwing.

Several authors have observed the motor ability of mentally retarded children in a variety of tasks and reported that the retarded child scores consistently lower than a non-retarded child on tasks involving strength, speed of running, jumping, and ball throwing. Francis and Rarick (10) examined the performance of mentally retarded boys and girls on tests involving strength, balance, power, and ability. When their sample was compared to a non-retarded sample, they observed that intelligence was positively related with the motor performance tests and that the mean performance scores for the mentally retarded group compared favorably with

non-retarded subjects two to four years younger. Retardates' strength development followed that of normals but at a lower level (2-4 years behind) and the discrepancy increased with age. Malpass (14) studied the motor proficiency of institutionalized retarded children and non-institutionalized normal children on the Lincoln adaptation of the Oseretsky Test. He found that the retarded children scored significantly poorer than the normal children on all of the proficiency tests. The relationship of age, intelligence, and sex to motor proficiency of institutionalized mentally defective children was investigated by Rabin (16). Motor proficiency was found to have a significant positive relationship with age. He indicated that a significant positive relationship was present between intelligence and motor proficiency when the variables were adequately controlled.

Because the motor ability of a mentally retarded child is not developed to the same extent as that of a non-retarded child, his freedom of movement is impaired subsequently affecting his feelings of confidence, achievement, and success. This lack of general motor ability is quite possibly related to and influenced by the perceptual-motor ability of the retarded child. Perceptual-motor ability, according to Drowatzky (7), refers to the "interaction of the sensory system, which provides the information about the environment, and the motor or muscular system, which allows the organism to respond to its environment." Several authors have reported that the retarded child demonstrates impaired performance on tasks indicative of perceptual-motor ability in areas such as visual perception, reaction time, and balance.

For example, an extensive study by Goldiamond (11) involving a series of perceptual tasks found that mentally retarded children had higher (slower) reaction time scores at each age than the non-retarded children.

When the relationship between intelligence and simple reaction time in mental defectives was studied by Ellis and Sloan (8), they found a moderate, inverse, and rectilinear relationship between intelligence and simple reaction time indicating that as intelligence increased the reaction time decreased. Cratty (5) investigated the perceptual attributes of mentally retarded children and youth on a battery of tests consisting of: body perception, gross ability, balance, locomotion agility, throwing, and tackling. A correlation of .63 was obtained between intelligence quotient and the gross motor scores achieved by mentally retarded children.

Human performance differences are due, according to Fitts and Posner (9), to variations in information processing (input - integration - output). They explain that performance is dependent upon: sensory capacities, perceptual processes, memory processes, and response processes. Sensory capacities describe the ability to detect, compare, and recognize stimuli. Perceptual processes relate to meanings of stimule through pattern recognition, selective attention, and rate of search. Memory processes refer to sensory storage, spans of attention and memory, short term memory, and serial memory. Response processes describe the variety, accuracy, timing, and repetition of movements.

Perhaps a unique information processing ability of mentally retarded children precipitates the varied gross-motor and perceptual-motor responese that are characteristic of these children. However, at present the extent to which the motor ability of mentally retarded children is impaired by their lact of perceptual ability is not clear.

In addition, some variation in motor skill performance of various etiologically classified groups of retarded children has been observed by several researchers but these reports lack consistency. For example,

Clausen (4) concluded that Down's Syndrome subjects were more impaired with regard to sensory acuity and perceptual speed than the non-Down Syndrome subjects of comparable age and intelligence levels. The reaction time ability of the organic retardates was found by Bensburg and Cantor (2) to be significantly slower than the familial retarded on the various tasks indicative of simple and complex reaction time. A study by Auxter (1) reported no significant difference between non-brain damaged, brain damaged, and undifferentiated mentally retarded boys on the various proprioceptive tasks except for a task dealing with balance. Therefore, the difference in the motor ability of etiologically classified mentally retarded children was not clear.

Thus, there is a definite need to compare the performances of retarded children and non-retarded children on specific tasks that require varying levels of perceptual-motor ability and to evaluate the difference in the motor ability of etiologically classified groups of retarded children. Information about the perceptual-motor behavior of a retarded child will enable a teacher to provide a learning situation which is cognizant of these abilities. Moreover, determining the extent of the motor ability differences among retarded children of varied etiological characterizations, i.e., Down's Syndrome vs. cultural, furthers the knowledge a teacher needs in order to develop the general motoric behavior necessary to allow the child to experience his environment using consistent and efficient motor patterns.

Purpose of the Study

The purpose of this study was to compare the performances of mentally retarded and non-mentally retarded children on specific motor tasks to evaluate the retarded child's perceptual-motor ability and its relationship

to his gross-motor performance. A further purpose of this investigation was to examine the variance in motor ability reported among mentally retarded children etiologically classified as Down's Syndrome, cultural-familial, and other. The following hypotheses were established to guide this investigation: (1) there is no significant relationship between the retarded subjects' intelligence quotient, age, reaction time, movement time, ability run, 20 yard dash, obstacle run, target hop and motor ability scores; (2) there is no significant relationship between the non-retarded subjects' intelligence quotient, age, reaction time, movement time, ability run, 20 yard dash, obstacle run, target hop and motor ability scores; (3) there is no significant difference between the motor ability of the non-retarded children and that of the retarded children; and (4) there is no significant difference in the motor ability of the etiological groups of retarded children.

Subjects

The subjects for this study consisted of 30 children involved in the Mt. Pleasant, Michigan Public School System who were 10, 11, or 12 years of age and diagnosed as mentally retarded. Retardation, according to the American Association of Mental Deficiency, refers to subaverage general intellectual functioning originating during the developmental period and is associated with impairment in adaptive behavior. Subaverage general intellectual function for the purpose of this research referred to mental performance that was more than one standard deviation below the population mean for a standard intelligence test. The retarded subjects therefore had IQ scores below approximately 80. They were also classified by the Mt. Pleasant Public School Special Education Department into three groups on the basis of etiology. These groups were: Down's Syndrome,

cultural-familial, and other (organic and/or physiological). Only those children who, in the opinion of the Special Education Department personnel, could complete the tasks were used as subjects in this study. This procedure was followed to eliminate any possibility of a "floor" influence on the data.

The Down's Syndrome group contained 5 boys and 5 girls whose ages ranged from 10 years 2 months to 12 years 8 months with a mean age of 11 years 5 months. Their IQ scores ranged from 32 to 48 with a mean score of 40.3. The cultural-familial group consisted of 5 boys and 5 girls whose ages ranged from 10 years 1 month to 12 years 7 months with a mean age of 11 years 6 months. Their IQ scores ranged from 52 to 79 with a mean score of 66.5. The group classified as other (organic and/or physiological) consisted of 6 boys and 4 girls whose ages ranged from 10 years 1 month to 12 years 9 months with a mean age of 11 years 7 months. Their IQ scores ranged from 32 to 54 with a mean score of 42.9. The mean chronological age of the retarded children was 11 years 6 months, and the mean IQ score was 49.9.

The non-retarded children were randomly selected from the elementary school population of Mt. Pleasant, Michigan and ranged in age from 10 years 1 month to 12 years 8 months with a mean age of 11 years 4 months. The group consisted of 13 boys and 12 girls whose IQ scores ranged from 95 to 129 with a mean score of 104.88.

Perceptual- and Gross-motor Tasks

The tasks used in this study consisted of simple reaction time, movement time, agility run, twenty-yard dash, obstacle course, and target hop. The reaction time and the movement time tasks were timed using a device designed by John N. Drowatzky of The University of Toledo, Ohio. This

device consisted of a control panel that provided for various configurations of stimulus-response situations, a stimulus light which, when presented to the subject, activated a 100 millisecond chronoscope that operated until the subject removed his hand from a pad-switch thus recording reaction time. A second 100 millisecond chronoscope was activated when the subject removed his hand from the RT pad-switch and stopped when the subject touched a second pad-switch thus recording movement time. The remaining four tasks were timed with a stop-watch. A description of each task follows:

Reaction time - Movement time: Reaction time refers to the elapsed time from the presentation of a stimulus until the initiation of the movement. This score was obtained by the subject placing his hand on a pad-switch and removing it at the presentation of a light stimulus. Movement time refers to the elapsed time from the initiation of a movement until the completion of the movement. This time was obtained by the subject placing his hand on a pad-switch and moving it upon the presentation of a light stimulus to a pad located 12 inches away. The score used for both of these tasks was the elapsed mean time for 12 trials.

Twenty-yard dash: The subject ran at maximum speed for twenty yards. Score used was the elapsed mean time for 2 trials.

Agility run: The subject ran between two lines that were 10 feet apart at maximum speed touching each line with one foot. This was repeated ten times. Score used was the elapsed mean time of 2 trials.

Obstacle course: The subject ran through a course that consisted of 3 obstacles each 10 years apart. He was to go either over or under the cross bar as instructed prior to beginning the course. The course appeared as indicated in Figure 1. Score used was the mean elapsed time for 2 trials.

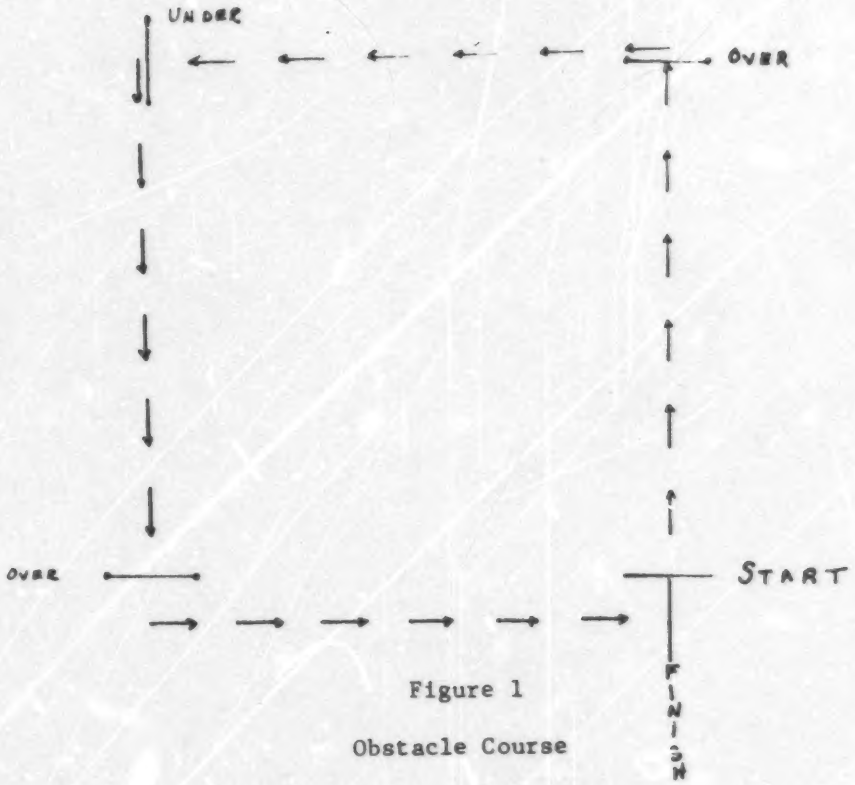

Figure 1

Obstacle Course

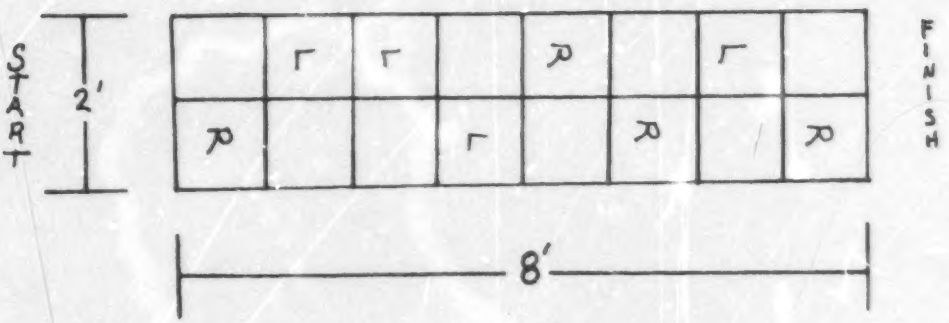

Figure 2

Target Hop

Target hop: The subject hopped through a "hop-scotch" like series of 12 inch squares landing on either the right or left foot as required by the color and the letter in the square. A red 'R' called for the right foot, while a white 'L' called for the use of the left foot. The series of squares appeared as shown in Figure 2. Score used was the mean elapsed time for three trials, plus errors.

Testing Procedure

The data was collected during six testing sessions, each approximately one hour in length by a test-team that consisted of the author and three trained assistants. The tests were administered in the school where the subjects were enrolled with each subject wearing the appropriate "gym-class" dress, which involved gym shoes and slacks. Each subject was given an orientation to the experiment which consisted of why they were doing these activities ("we want to see if you can play these games") and instructions about how to do the tasks ("do these games as well as you can").

Tasks were presented to all subjects in the same sequence. This sequence was reaction time, movement time, agility run, twenty-yard dash, obstacle course, and target hop. This sequential order was selected to proceed from the more simple to the more complex tasks during the testing of each child.

A summary of the descriptive information obtained for subjects involved in this study appears in Tables 1 and 2.

Discussion

The correlational matrix (Table 3) revealed several significant relationships among the retarded subjects' IQ, age, and the perceptual- and gross-motor variables. An interaction of importance was between IQ and

TABLE 1

DESCRIPTION OF RETARDED SUBJECTS AND THEIR MEAN PERFORMANCES

Variables	Mean	σ
Age (10.1 - 12.9 years)	11.59 years	.91
IQ (32 - 79)	49.90 points	14.00
Reaction Time	.43 seconds	.19
Movement Time	.39 seconds	.13
20 yd. Dash	5.13 seconds	1.14
Agility Run	24.43 seconds	4.89
Obstacle Run	22.90 seconds	9.01
Target Hop	7.99 seconds	4.19
Motor Ability	61.27 seconds	15.91

TABLE 2

DESCRIPTION OF NORMAL SUBJECTS AND THEIR MEAN PERFORMANCES

Variables	Mean	σ
Age (10.1 - 12.8 years)	11.40 years	.86
IQ (95 - 127)	104.88 points	8.18
Reaction Time	.25 seconds	.04
Movement Time	.20 seconds	.05
20 yd. Dash	4.02 seconds	.41
Agility Run	16.25 seconds	1.95
Obstacle Run	13.17 seconds	1.44
Target Hop	3.46 seconds	.98
Motor Ability	37.35 seconds	4.17

motor ability where a significant correlation (-.64) was obtained, indicating that with these subjects as the IQ score increased the time indicator of motor ability improved (decreased). This observation was consistent with results obtained by several authors, Rabin (16) and Francis and Rarick (10) found that motor performance was positively correlated with intelligence, and that this relationship was significant in retarded subjects. A study undertaken by Cratty (5) obtained a correlation of .63 between IQ and the gross-motor scores achieved by the mentally retarded children; this correlation is similar to the relationship observed in this study (-.64).

Observation of the relationship between IQ and reaction time revealed a negative significant correlation (-.60) indicating that as the RT time improved (decreased) the subjects' IQ score increased. Work by Pascal (15) and Ellis and Sloan (8) corroborates this finding, as they also obtained a significant relationship between intelligence and reaction time in mentally retarded children. Groden (12) also found a negative correlation (-.71) between reaction time and intelligence; moreover, he investigated the influence of task complexity on the correlation and found a positive statistic of .78 between intelligence and task complexity. This was not true in this study as the correlation between IQ and the most difficult task (target hop) was not significant. However, these tasks were not comparable.

To ascertain the relationship between perceptual- and gross-motor abilities, a correlation between reaction and movement time and the motor ability scores of the children was calculated. No significant relationship was observed between the perceptual motor indicators and motor ability in the retarded group; however, in the non-retarded group

TABLE 3

CORRELATIONAL MATRIX OBTAINED WITH TASK SCORES FROM RETARDED SUBJECTS

Variables	1	2	3	4	5	6	7	8	9
1 Age		07	-08	-00	-31	-11	-14	-04	-14
2 Intelligence Quotient			-60*	-47*	-67*	-56*	-57	-32	-64*
3 Reaction Time				62*	35	11	20	32	28
4 Movement Time					27	13	08	18	17
5 20 yd. Dash						74*	76*	47*	86*
6 Agility							75*	24	85*
7 Obstacle								30	93*
8 Target									55*
9 Motor Ability									

Decimal points removed and figures rounded to two places
* significant at .05 level (.361)

TABLE 4

CORRELATIONAL MATRIX OBTAINED WITH TASK SCORES FROM NON-RETARDED SUBJECTS

Variables	1	2	3	4	5	6	7	8	9
1 Age		09	-43*	-32	-35	-44*	-63*	-64*	-62*
2 Intelligence Quotient			-05	30	08	67*	15	-02	14
3 Reaction Time				62*	52*	48*	43*	37	52*
4 Movement Time					48*	39[a]	42*	01	39[a]
5 20 yd. Dash						57*	65*	14	63*
6 Agility							79*	55*	94*
7 Obstacle								60*	93*
8 Target									72*
9 Motor Ability									

Decimal points removed and rounded to two places
* significant at .05 level (.396)
a - approximates significance

significant positive correlations were obtained. Therefore, it is not possible to predict the gross-motor performance of retarded children from their reaction time or movement time scores.

The correlation matrix for the non-retarded group (Table 4) resulted in the rejection of the null hypothesis as the non-retarded age variable, contrary to the retarded group, was found to be significantly related to the reaction time, agility, obstacle, target, and motor ability variables. Possibly age played a greater part in the differentiation of motor ability among the non-retarded as opposed to the retarded children where there was no significant relationship observed. No relationship was found between IQ and any of the variables tested in the non-retarded group which was consistent with current literature that concluded no significant relationship existed between IQ and motor ability except at the lower end of the IQ continuum (3). There appeared to be more significant intercorrelations for the normal children than for the retarded, which might have been influenced by the lack of past experience in gross-motor activity that is characteristic of retarded children.

There was a difference between the motor ability of the non-retarded children and that of the retarded children as examined by a one-way analysis of variance (Table 6). This was consistent with the findings of Malpass (14), who observed that retarded children were significantly poorer than the non-retarded children on specific motor proficiency tests. Goldiamond (11) observed significantly higher (slower) reaction time scores in retarded children than in non-retarded children. The difference between motor ability of retarded and non-retarded children obtained in this present study was characteristic of studies involving these groups; moreover, that the retarded child is two to four years behind the non-

TABLE 5

MOTOR ABILITY

Group	Size	Mean	σ
Non-Retarded	25	37.34660	4.16963
Retarded	30	61.27160	15.91486
Down's Syndrome	10	68.02730	14.17006
Cultural/Familial	10	46.91920	4.17357
Other	10	68.86830	15.94403

TABLE 6

ANALYSIS OF VARIANCE

Combined Retarded and Non-Retarded

Source	Sum of Squares	DF	Mean Square	F Ratio
Between Means	7805.5312	1	7805.532	*53.2941
Within	7762.4588	53	146.4615	
Total	15567.9901	54		

* significant at .05 level (critical statistic 4.01)

retarded child of the same chronological age (10) is an important consideration when developing movement experiences for these children.

A large standard deviation was evident in the motor ability score of the retarded children (Table 5) indicating a considerable amount of variability among the subjects. This variability has been reported in the literature as a behavioral characteristic of retarded children in an experimental setting. Scott (17) observed that low IQ children were significantly more variable in their response to any of the tests that she presented than were the high IQ subjects. Bensberg and Cantor (2), in studying the reaction time in mental defectives with organic and familial etiology, concluded that mental defectives are not homogeneous in behavior characteristics, but demonstrate very diverse behavior from one person to another. This was evident in the testing situation for this research as the retarded children were observed to have extreme variability (large standard deviation) in the performance of the tasks, as opposed to the non-retarded children who performed the same tasks but did not exhibit the extreme variability.

An analysis of variance (Table 7) indicated that significant differences were present in the motor ability performances of the etiologically classified groups of retarded children, again illustrating the heterogeneity of this sample. The variance observed among the retarded groups was apparently due to the difference between the cultural-familial and the other groups. Therefore, a ranking of the various groups on the basis of mean motor ability score was as follows (Table 8): cultural-familial, Down's Syndrome, and other (organic/physiological). Those results somewhat confirmed the information obtained by other investigators. For example, Berkson (3) observed that Down's Syndrome children are slower in reaction

TABLE 7

ANALYSIS OF VARIANCE

Comparison of Etiologically Grouped Retarded

Source	Sum of Squares	DF	Mean Square	F Ratio
Between Means	10898.9384	3	3632.9795	*39.6830
Within	4669.0516	51	91.5500	
Total	15567.9901	54		

* significant at the .05 level (critical statistic 8.58)

TABLE 8

ANALYSIS OF MEANS

Comparison of Various Groups of Subjects

Group	Compared to	Difference Between Mean
Non-retarded	Cultural-familial	9.57260
Non-retarded	Down's Syndrome	30.68070 +
Non-retarded	Other	31.86830 +
Down's Syndrome	Cultural-familial	21.10810
Down's Syndrome	Other	.84100
Other	Cultural-familial	21.89910 *

+ significant at critical value of 18.163 (uneven numbered groups) at .05 level.

* significant at critical value of 21.709 (even numbered groups) at .05 level.

time than cultural-familial defectives, and Clausen (4) found that Down's Syndrome subjects were more impaired than non-Down's Syndrome subjects on tasks involving perceptual speed. The absence of significant differences between the Down's Syndrome and the other (organic/physiological) group in the present study and the lack of a significant difference between the Down's Syndrome and the cultural-familial group (but the figures were extremely close to significance) suggested that the tests employed in this study might not have been sufficiently precise to differentiate between the groups of retarded children. A second consideration was that, with regard to these subjects, a pattern of motor ability is not characteristic of a specific etiologically classified group of retarded children. This is consistent with current educational practice which attempts to avoid the classification of retarded children on the basis of IQ and/or etiology, but approaches experiential situations on the basis of individual ability.

Conclusions

Within the framework of this study the following conclusions appeared warranted: there was a considerable amount of variability among the retarded subjects indicating that retarded children are not homogeneous with regard to motor ability characteristics, but demonstrate very diverse behavior from one person to another. Secondly, a pattern of motor ability was not characteristic of a specific etiologically classified group of retarded children, thereby reinforcing the importance of providing movement experiences for retarded children on the basis of individual rather than group ability. Finally, there was a significant relationship between intelligence and the motor ability performance of mentally retarded children; however, for the non-retarded children no significant relationship was obtained.

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